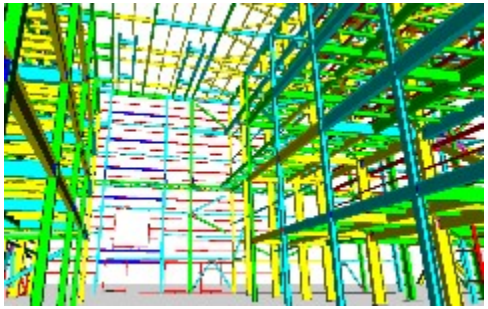
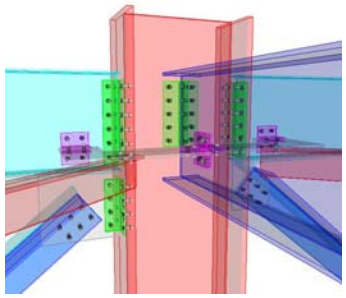
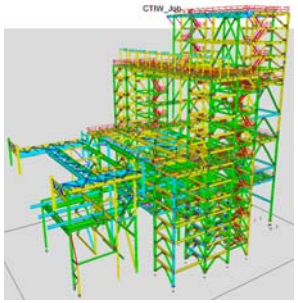
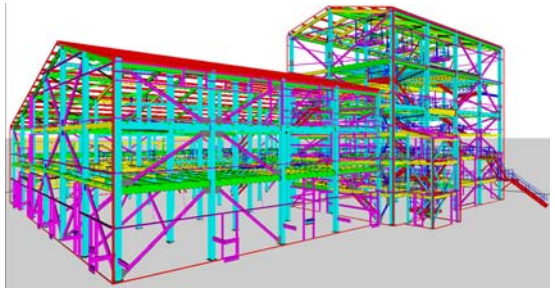
Interoperability with CIS/2 and IFC

Robert Lipman

National Institute of Standards and Technology (NIST)

Building and Fire Research Laboratory

Computer Integrated Building Processes Group

Gaithersburg, Maryland

cis2.nist.gov

NASCC - BIM 102 for the Steel Fabricator – 1 April 2009, Phoenix, AZ

Outline

- BIM and Interoperability
- Why Product Models and Interoperability?
- CIS/2 – CIMsteel Integration Standards
- SteelVis - CIS/2 Viewer
- Demo
- CIS/2 Interoperability Issues
- IFC – Industry Foundation Classes
- Interaction between CIS/2 and IFC

- **DISCLAIMER**: Any mention of commercial products in this presentation is for information only; it does not imply recommendation or endorsement by NIST.

BIM and Interoperability

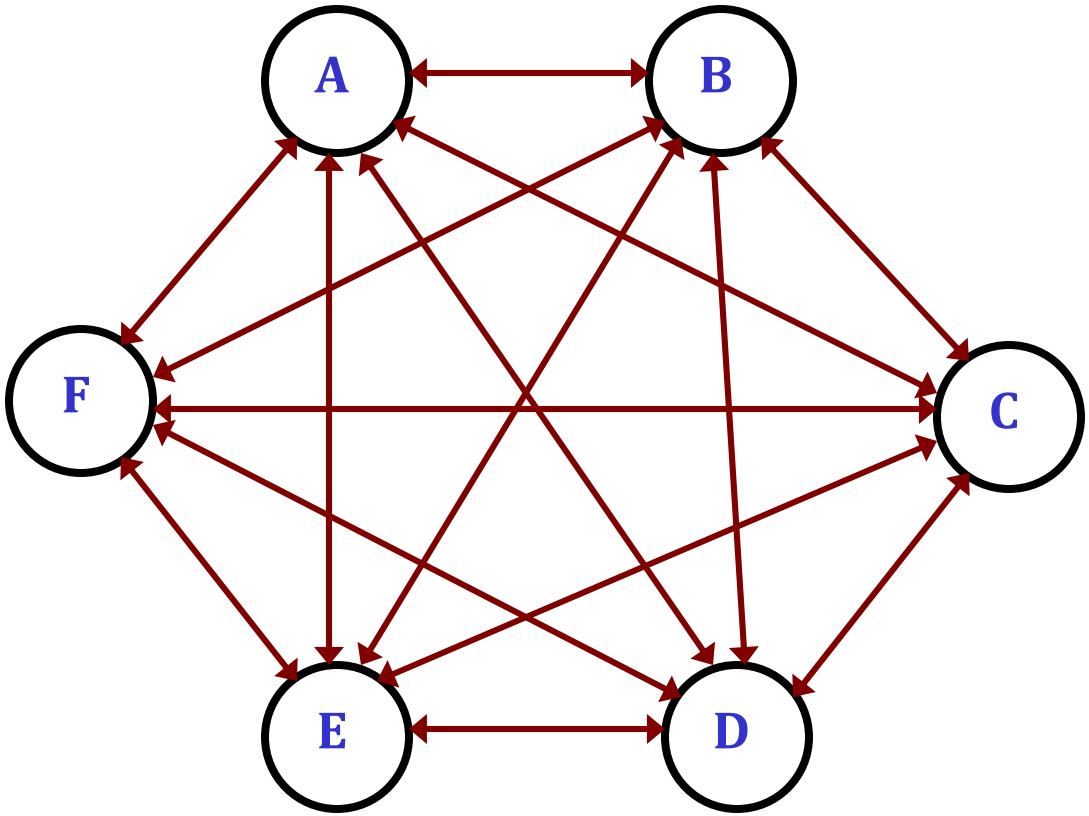
- A Building Information Model (BIM) is a **digital representation** of physical and functional characteristics of a facility. As such it serves as a **shared knowledge resource for information** about a facility forming a reliable basis for decisions during its **life-cycle from inception onward**.

- A basic premise of BIM is **collaboration by different stakeholders** at different phases of the life cycle of a facility to **insert, extract, update or modify information** in the BIM to support and reflect the roles of that stakeholder. The BIM is a shared digital representation founded on **open standards for interoperability**.

- Interoperability is necessary for BIM
- Software is tool used for BIM
- BIM is not necessarily software or one model of everything
- BIM is also a process

- **www.buildingsmart.com**

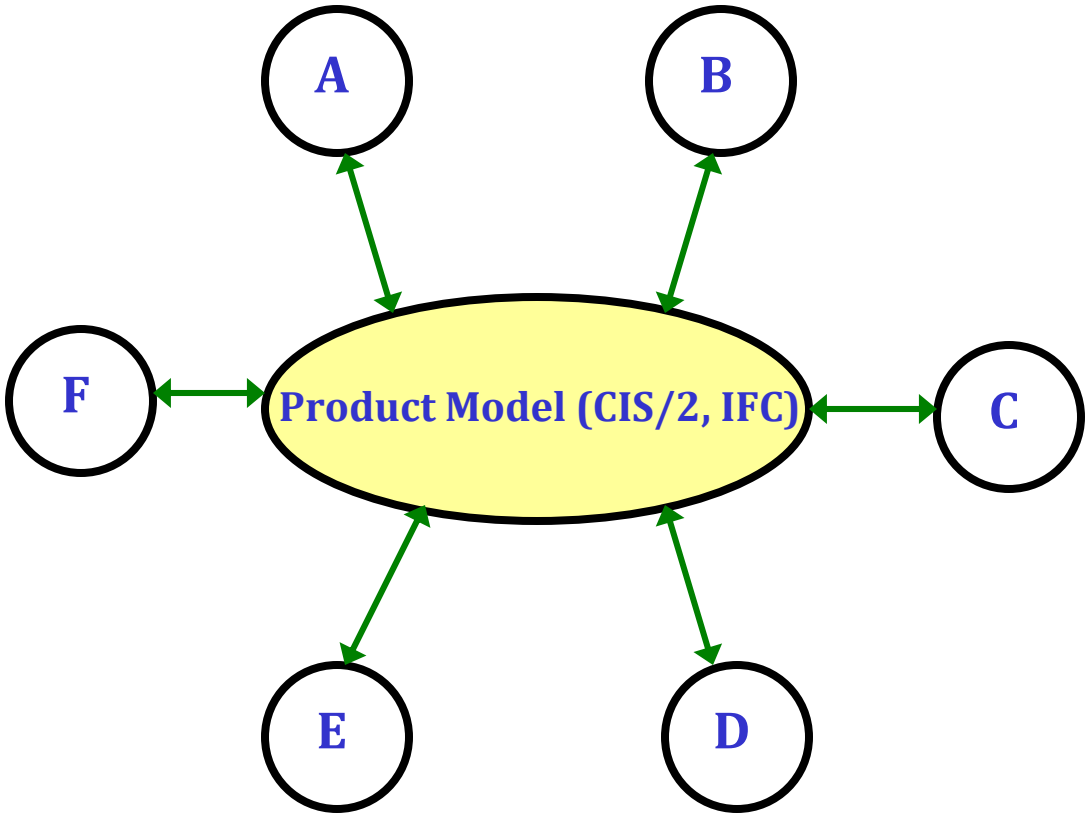
Why Product Models and Interoperability?



- 6 software packages
- Each has proprietary format
- Import and export
- N*(N-1) translators
- 30 import and export translators (N=6)
- Adding another software package is 12 translators (N=7)

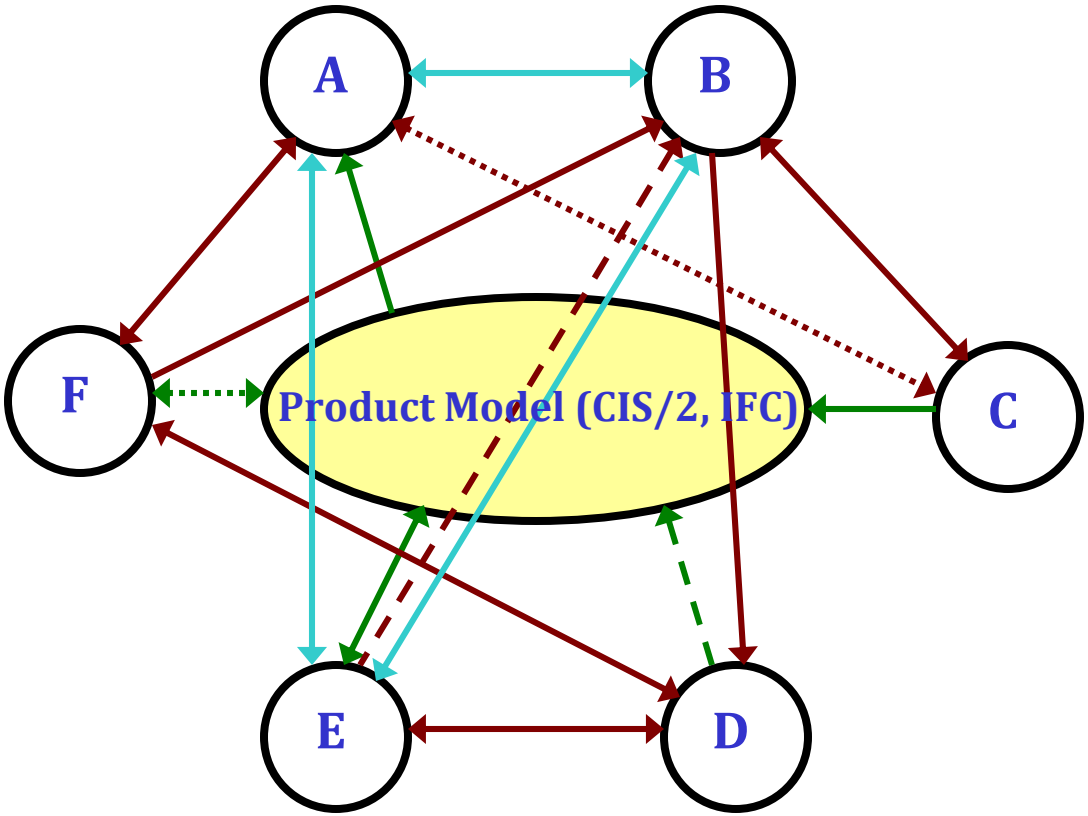
NIST study on cost (to AE, OO, GC, Fab.) of inadequate interoperability - $15.8B
Manually reentering information in design and construction phase - $491M

Why Product Models and Interoperability?



- 6 software packages
- Translate to and from product model
- Import and export
- 2*N translators
- 12 translators
- Adding another software package is only 2 translators

Interoperability In Reality



- Old formats survive (KISS, SDNF)
- Import OR export
- Incomplete implementation or product model
- Geometry vs. objects
- Software APIs and consolidation
- Strategic alliances
- Vendor specific information

What is CIS/2?

- CIMsteel Integration Standards (version 2)
- aka LPM/6 (Logical Product Model)

- Developed at the Steel Construction Institute (UK)
- Adopted by AISC in 1998
- 28+ implementations import and/or export

- Design, Analysis, and Detailed models (views) of a structure
- Logical relationship between models
- Parts, assemblies, loads, reactions, materials, connections, …

What is CIS/2?

- Has been very successful
- At the forefront of interoperability
- Well defined domain and workflows

- Room for improvement in the quality and scope of implementations
- Parts of the CIS/2 standard have never been implemented

- No certification or testing of implementations

SteelVis - CIS/2 to VRML Translator

- NIST developed SteelVis in 2000
- **Download for FREE at: cis2.nist.gov**
- Only CIS/2 viewer available

- VRML – Virtual Reality Modeling Language
- 3D in a web browser
- Free VRML plugins

- Tested with 100s of CIS/2 files
- Over 2400 downloads
- Current Version 7.90

SteelVis - CIS/2 to VRML Translator

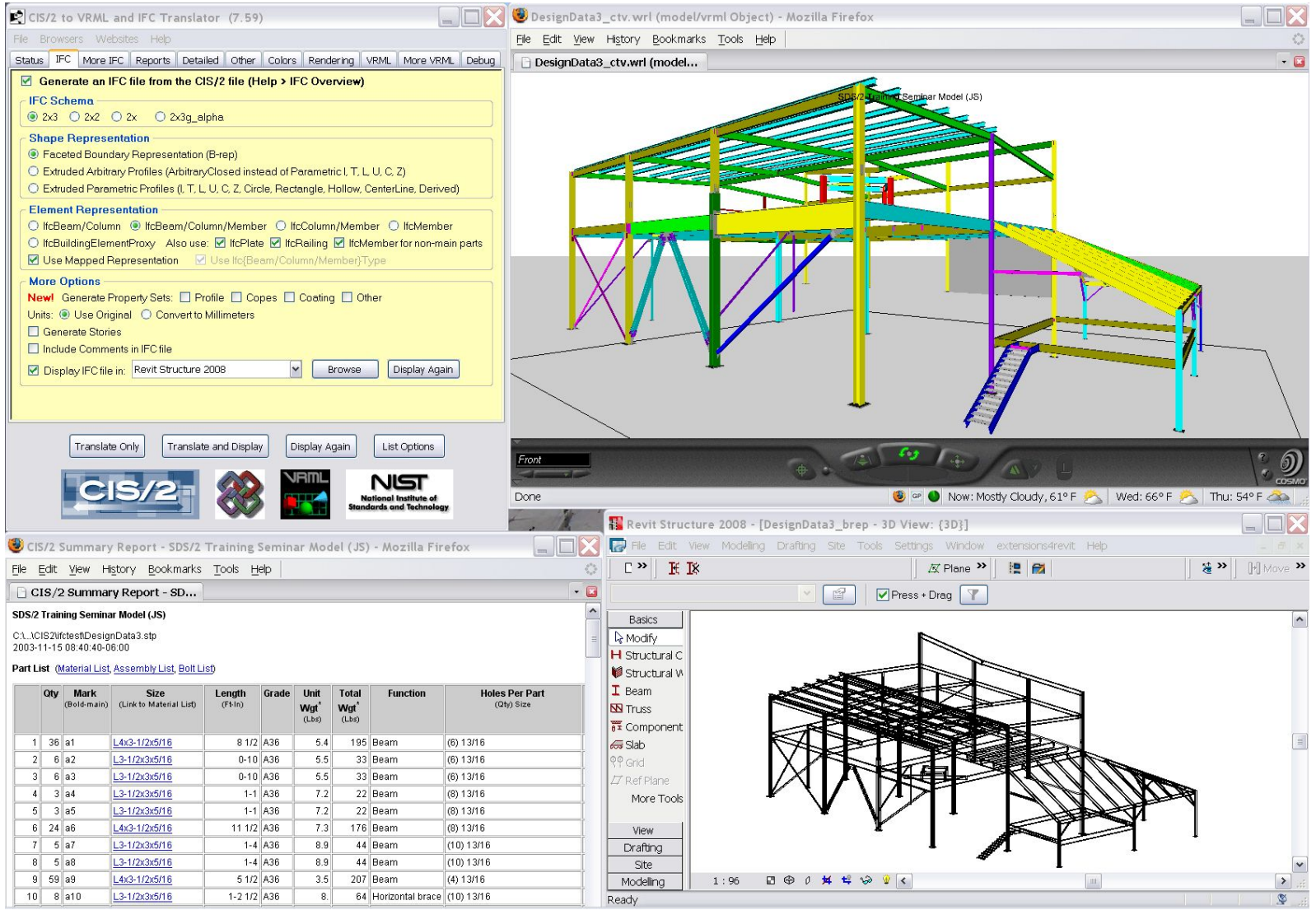
- Software developers use it to verify their CIS/2 export
- End users use it for model checking, design review, model sharing, electronic RFI, marketing, BOM, …
- Integration with 3D PDF, Google Earth, Google SketchUp
- **Disclaimer: A CIS/2 file that looks correct as a VRML model does not imply that the file conforms to the CIS/2 standard, recommended practices, software implementers agreements, or that it can be imported to another CIS/2 application**

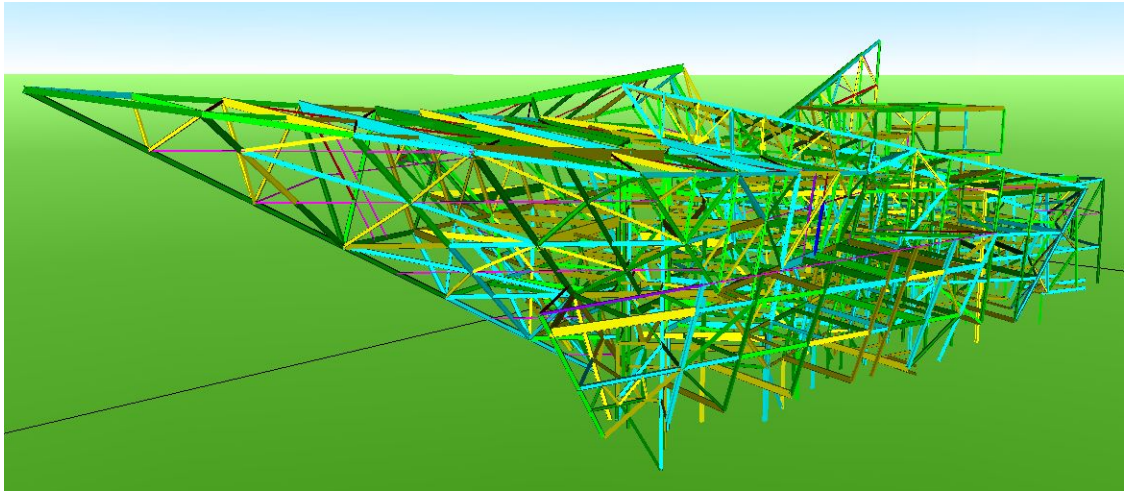
SteelVis user interface

VRML model

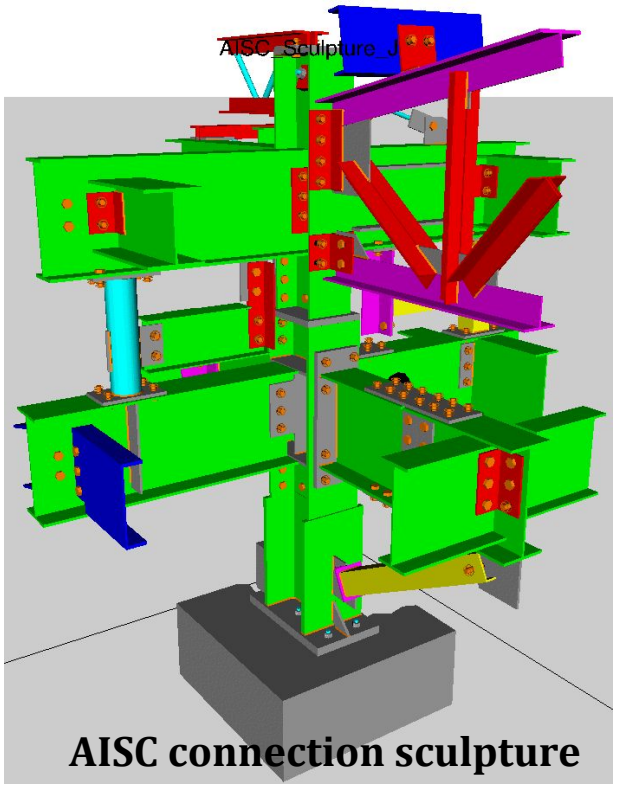
Part summary

IFC model

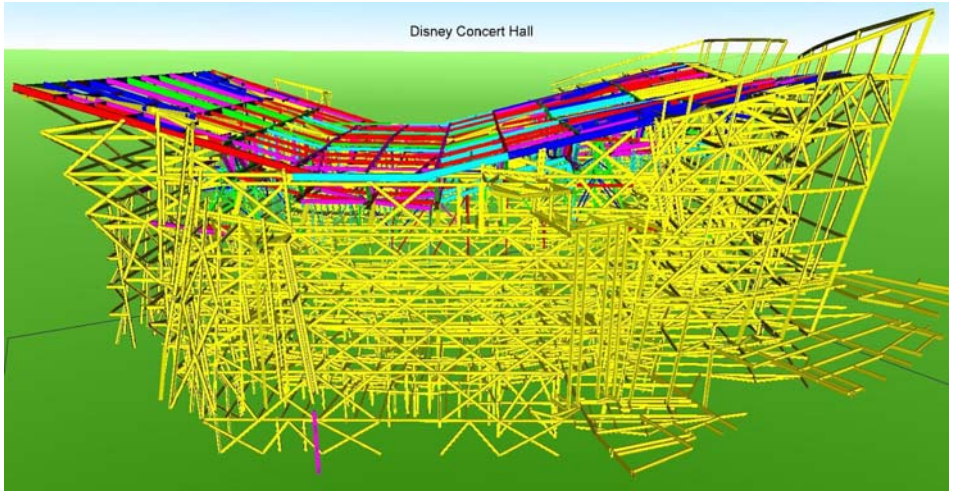




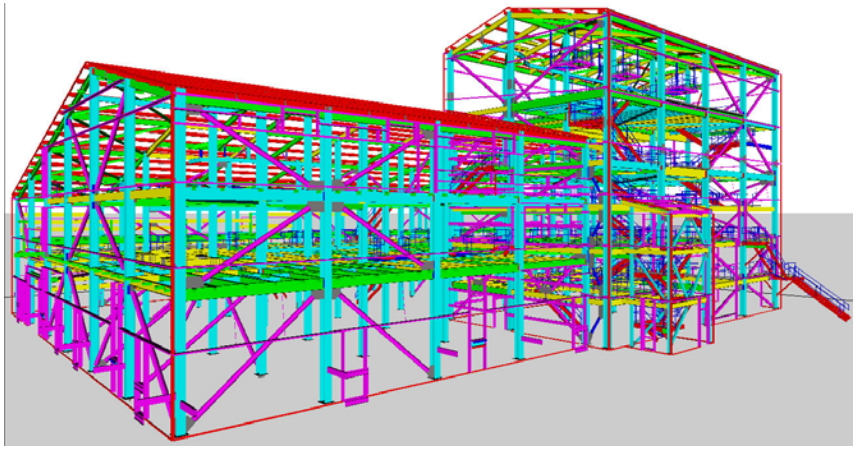
Denver Art Museum



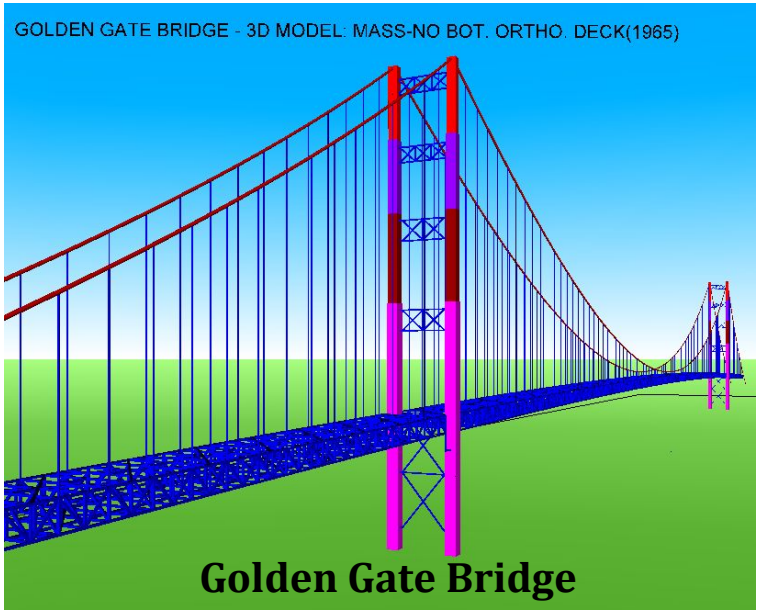
AISC connection sculpture



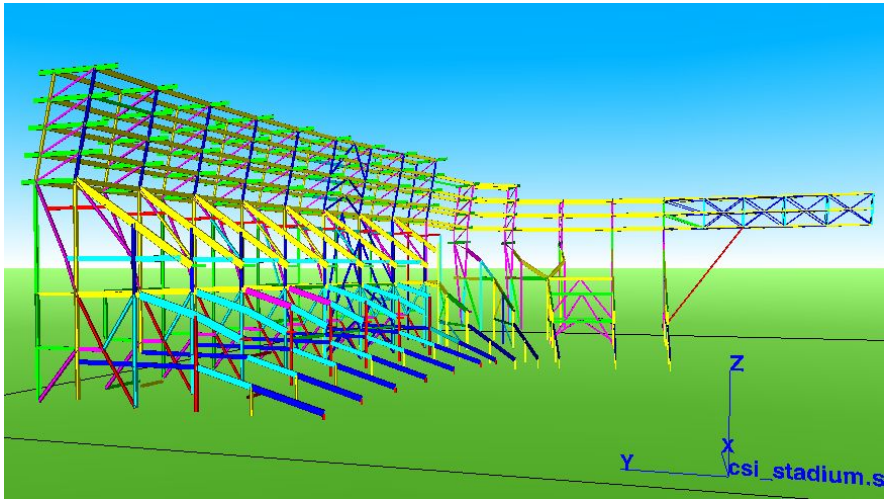
Disney Concert Hall



VRML from CIS/2 files

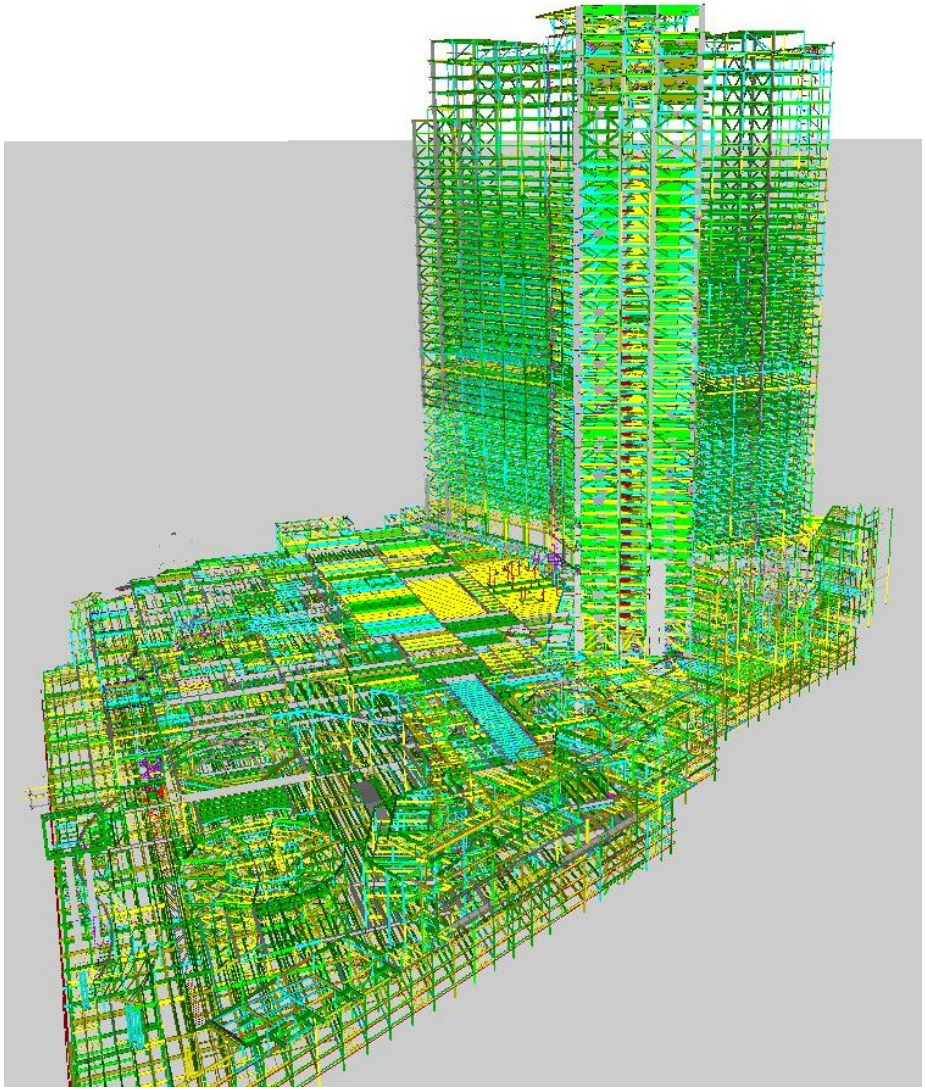


Golden Gate Bridge



Soldier Field

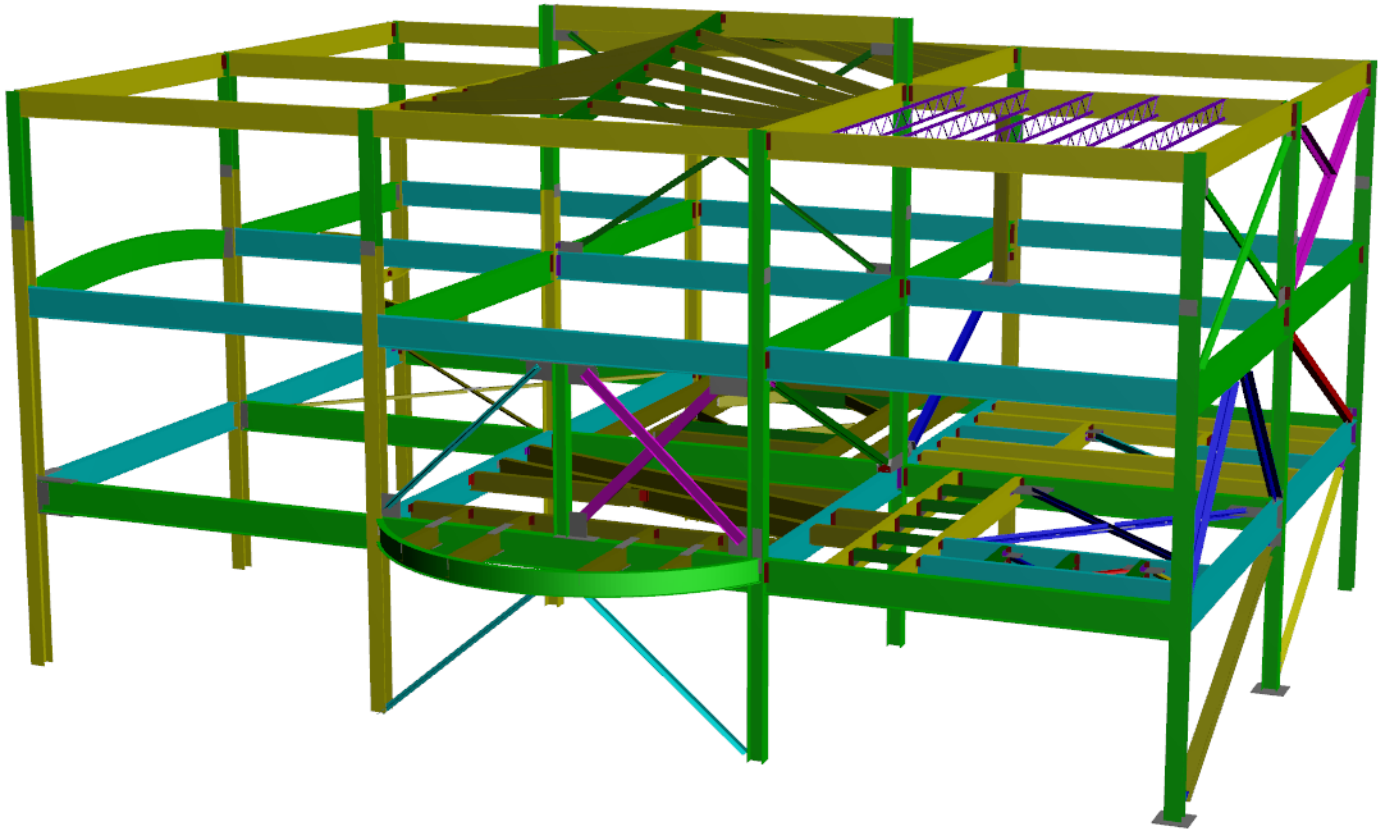
Las Vegas hotel – 6 CIS/2 files – 230,503 parts



SteelVis - Features

- Reports for: Part, Material, Assembly, and Bolt
- Text popups
- Copes, bolts, shear studs, holes, welds, sequences
- Analysis model wireframe and nodes
- Member labels, grid lines
- User-defined viewpoints
- Color by: section type, function, steel grade, sequence, surface treatment
- Shaded or transparent
- Merge with other VRML models
- Coordinate axes for debugging

- DEMO



CIS/2 Interoperability Issues

- Interoperability does not always work as planned
- SteelVis is only a visual verification
- CIS/2 information gets mapped to and from CAD

- Do a small representative test CIS/2 file exchange before exchanging the entire building
- Does CIS/2 in your software support your workflow?
- What CIS/2 export and import settings do you have to use?

- Does the imported information end up where you expect it?
- Is A992 the same as Steel-A992 or GRADE992?
- Is the top-of-steel correct in the analysis model?
- Are curved parts, bent plates, or corrugated decking supported?
- Section sizes with or without dimensions

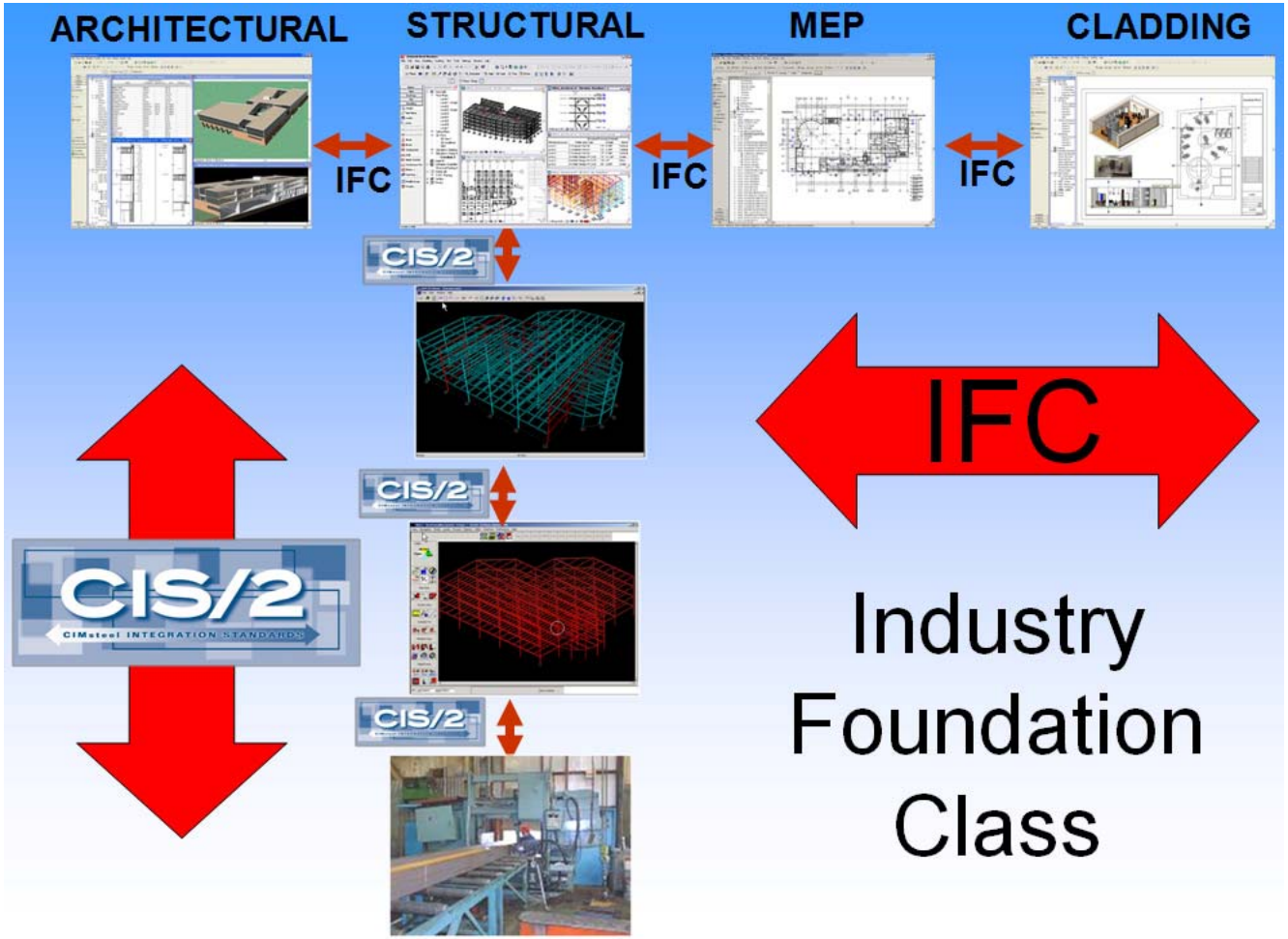
What is IFC?

- Industry Foundation Classes (IFC) is the **product model to facilitate interoperability in the building industry**
- Developed by the buildingSMART, formerly known as the IAI (International Alliance for Interoperability)
- Architecture, engineering, analysis, HVAC, facilities management, operations, quantity takeoff, energy simulation, code checking, cost estimating …
- Model views being developed based on business process and exchange requirements (IDM), define what needs to be implemented in software (MVD)

What is IFC?

- Implemented by most major CAD applications and many downstream applications (energy analysis, QTO, FM, …)
- Unlike CIS/2 there are many free IFC viewers, file browsers, syntax checkers, discussion forums, developer community, and organization
- Current version IFC2x3
- IFC has even more “Interoperability Issues”

Interaction Between CIS/2 and IFC



(Tom Faraone – AISC)

Interaction Between CIS/2 and IFC

- NIST developed CIS/2 to IFC translator in 2005
- Integrated with SteelVis
- For example, convert CIS/2 files from RAM and SDS/2 to IFC and import applications, such as Revit and ArchiCAD

- Identified deficiencies in IFC to handle structural steel, such as: bolts, holes, welds, copes, parametric profiles, attributes (section designator, piecemark, cardinal point), semantic meaning of design vs. detailed, parts in an assembly

- No IFC to CIS/2 translator

Interaction Between CIS/2 and IFC

- **Will IFC replace CIS/2?**

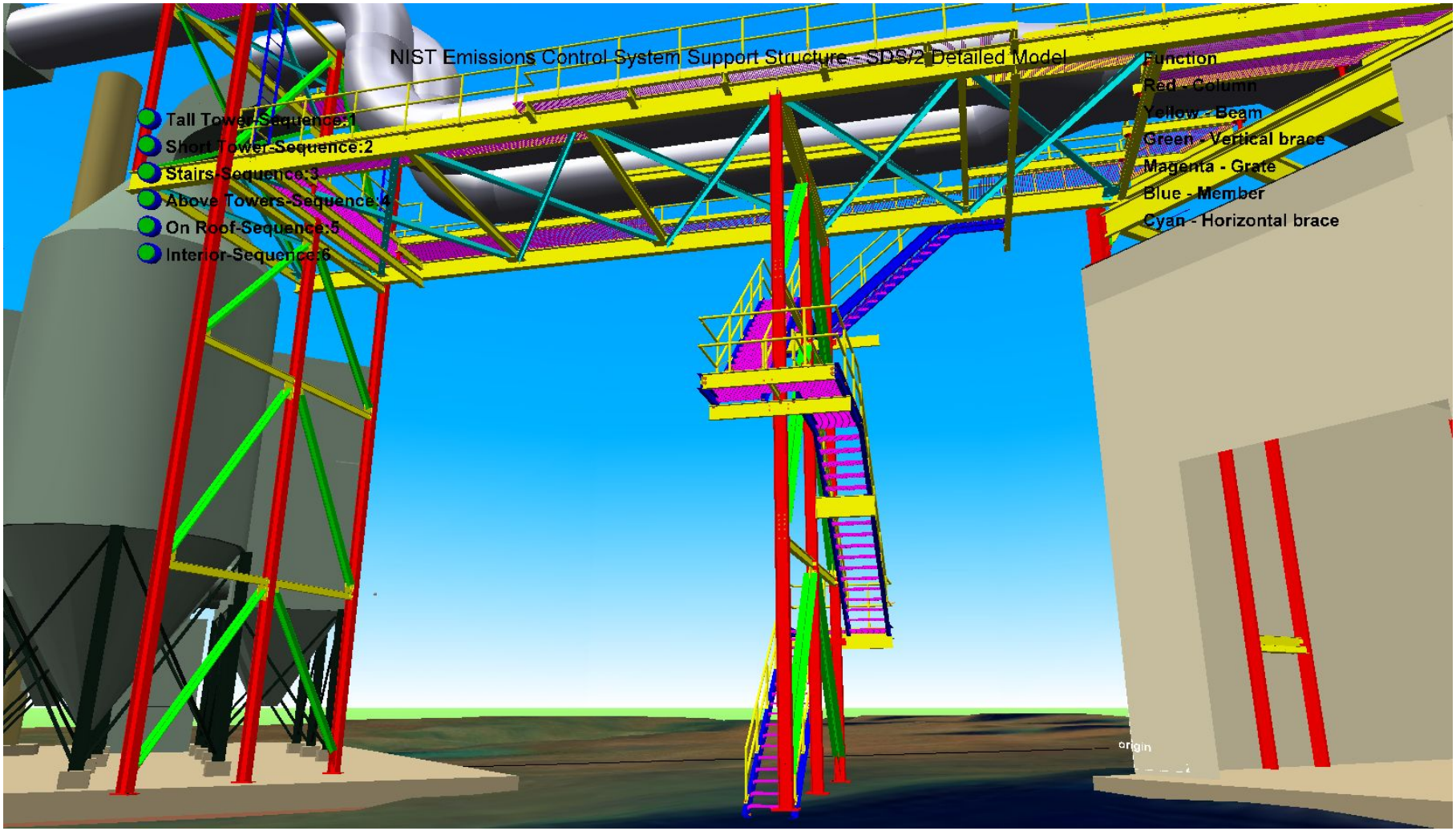
Interaction Between CIS/2 and IFC

- **Will IFC replace CIS/2?**
- **In my opinion – NO**

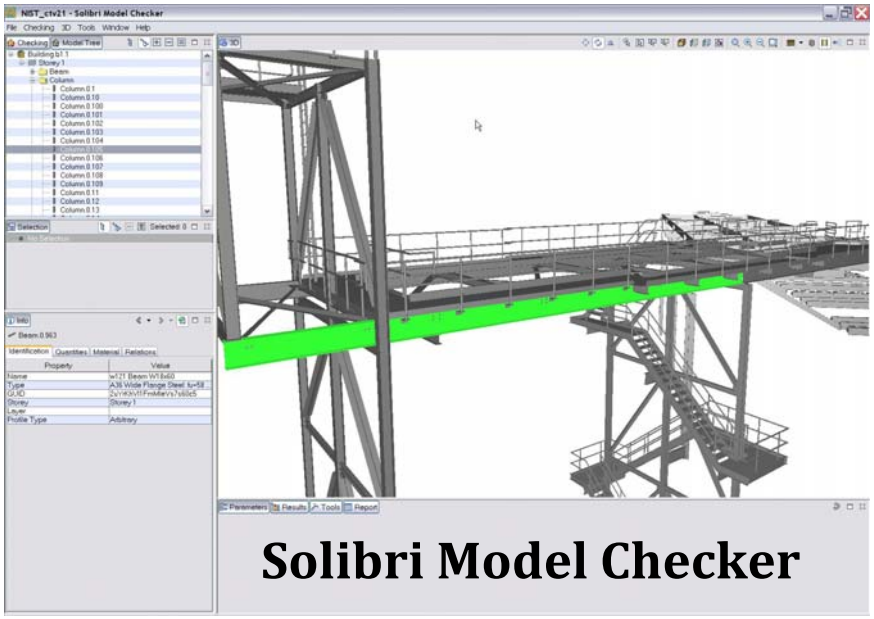
- CIS/2 is very good at what it does
- Future IFC standard will be better for steel
- IFC will not equal what CIS/2 can do
- More IFC "Interoperability Issues" related to steel
- Even with better IFC standard, will have to wait for software implementations

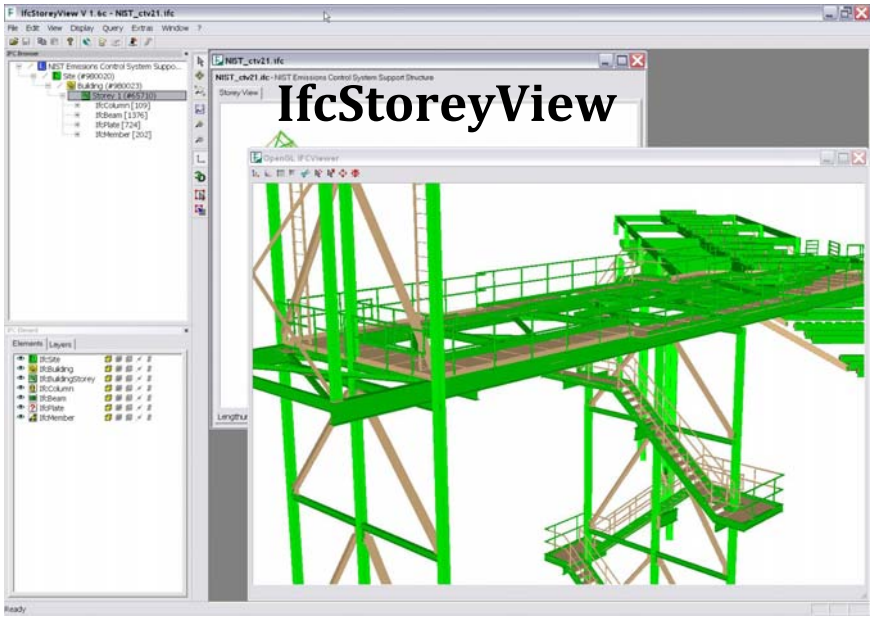
NIST Large Fire Research Facility - Emissions Control System (ECS)

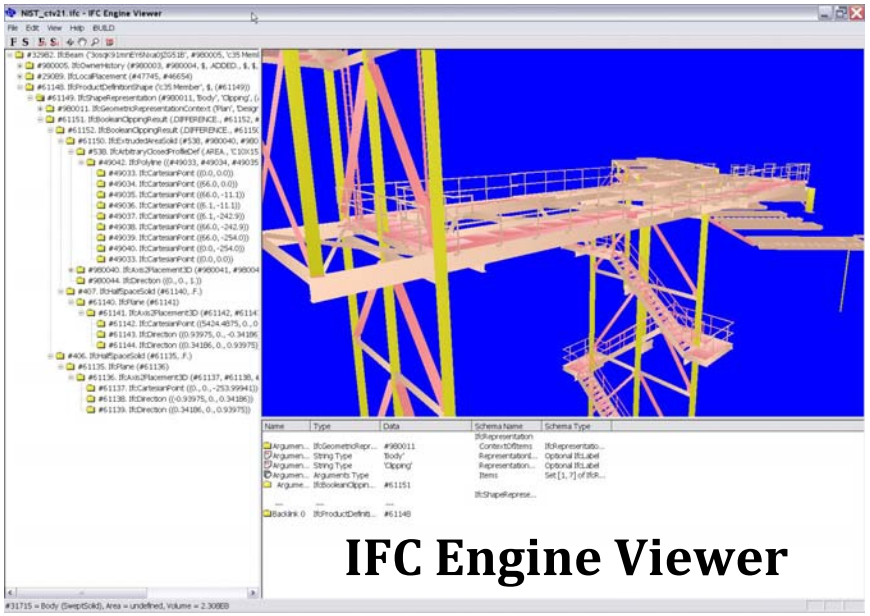
- Fire tests in building (right)
- Steel structure carries ducts to ECS (left)
- Steel detailed in SDS/2 and exported to CIS/2



Multicolored structure – VRML from CIS/2
Other structures – VRML modeled by hand



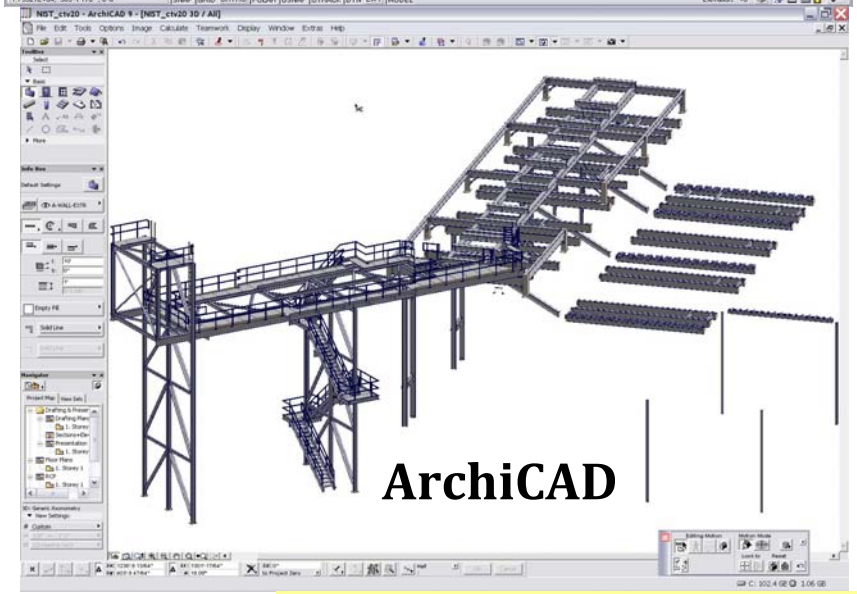


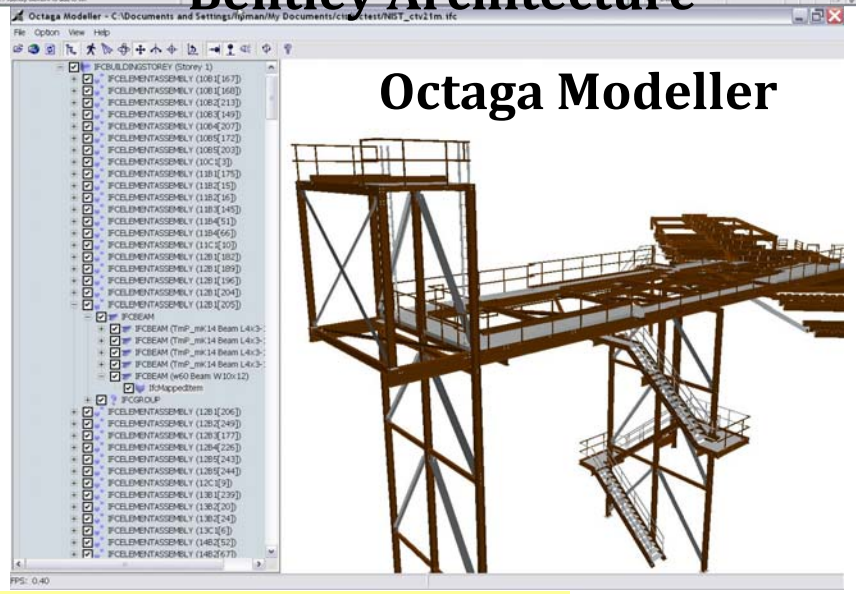


IFC file imported to IFC viewers and CAD apps

NIST
National Institute of Standards and Technology
Technology Administration, U.S. Department of Commerce

BUILDING AND FIRE RESEARCH LABORATORY





IFC file imported to IFC viewers and CAD apps

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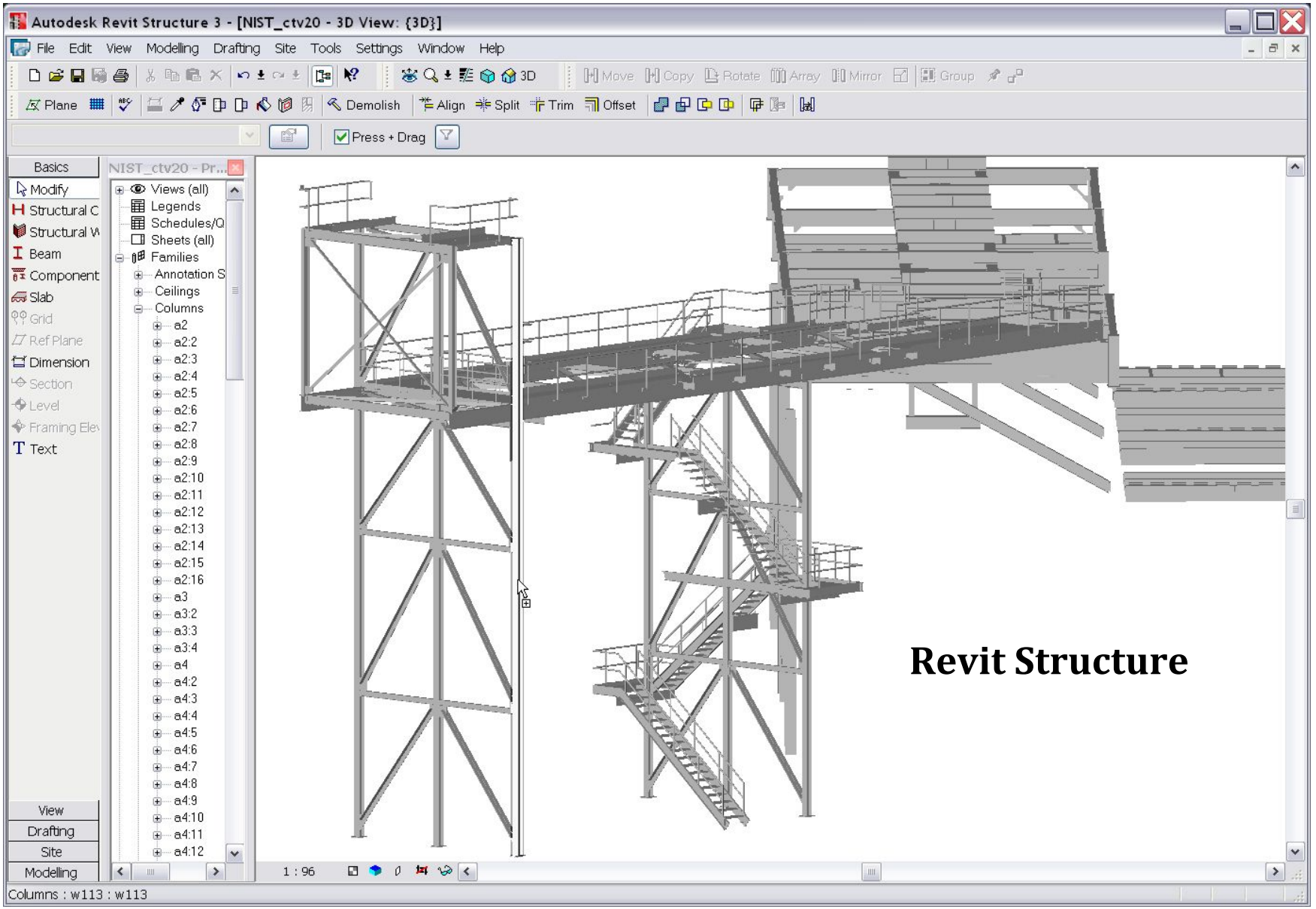
Autodesk Revit Structure 3 - [NIST_ctv20 - 3D View: {3D}]
File Edit View Modelling Drafting Site Tools Settings Window Help
Plane Demolish Align Split Trim Offset
Press + Drag
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Ref Plane
Dimension
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Level
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NIST_ctv20 - Pr...
Views (all)
Legends
Schedules/Q
Sheets (all)
Families
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Modelling
1 : 96
Columns : w113 : w113
Revit Structure

CIS/2 to IFC Interoperability Issues

- Pay attention to the messages in the CIS/2 to IFC translator
- IFC has multiple ways of representing the same geometry
- IFC information gets mapped to CAD internal representation

- What is a beam or a column in IFC?
- Where does the section designator or material grade end up?
- How are assemblies handled?
- Is the resulting geometry editable?

- Translator generates curved parts, bent plates, and decking in a valid way that might be incompatible with some IFC applications
- Translator can generate bolts and analysis models, but most IFC applications cannot handle them

Be an informed user!
For more information:

cis2.nist.gov